

Table 4.5.1 Paired sample T-test for main effect and interaction of the vowels [e], [ɛ], [ə] and their nasalized counterparts for Təŋu dialect speakers.

Vowel Pairs	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Dev.	Std. Error Mean	95% confidence In-terval of Difference				
				Lower	Upper			
e-ε	-114.67	221.57	40.45	-197.40	-31.93	-2.835	29	.008
e-ə	168.47	231.66	42.29	81.96	254.97	3.983	29	.000
ε-ə	283.13	247.90	45.26	190.57	375.70	6.256	29	.000
ẽ-ẽ	-20.27	181.21	33.09	-87.93	47.40	-613	29	.545
ẽ-ă	-28.89	117.55	22.62	-75.39	17.61	-1.277	26	.213
ĩ-ă	-50.30	153.70	29.58	-111.10	10.51	-1.700	26	.101
u-o	22.00	79.56	14.52	-7.71	51.71	1.515	29	.141
ũ-õ	-52.76	206.65	39.77	-134.51	28.99	-1.327	26	.196

4.6 Statistical Analysis of F1 and F2¹ Differences

This section discusses the differences and the similarities in the production of the vowels across the dialects in terms of F1 (height) and F2¹ (backness). One-way ANOVA results to examine the significant difference level of the vowels between the dialects are as follows:

Table 4.6.1 ANOVA of significant of effect of dialect on the oral vowels

Vowels		i	e	ɛ	ə	a	u	o	ɔ
Df		43	43	43	40	43	43	43	43
F	F1	1.628	9.787	9.005	8.510	.143	.735	1.047	1.249
	F2 ¹	.393	18.858	1.526	19.686	1.600	.172	.794	.189
Sig	F1	.187	.000	.000	.000	.965	.574	.395	.307
	F2 ¹	.812	.000	.214	.000	.194	.951	.537	.943

Table 4.6.1 indicates that with respect to F1, dialectal difference did not significantly affect F1 values of the vowels [i, a, u, o, ɔ], although the significant level of [i], (F (5) = 0.393, p<0.187) is quite lower as compared to the others. There was however a significant difference in F1 of the mid front vowels [e] and

[ɛ], and the central vowel [ə]. The result as shown has a significant effect difference value of $p < .05$ indicating that the F1 for these vowels are different across all dialects. For F2¹, the result showed a significant difference between the dialects for [e] and [ə] with $p < 0.05$ meaning that F2¹ of the vowels [e] and [ə] differ across the dialects.

For [e], post-hoc tukey with subset for $\alpha = .05$ indicates a homogeneous subset of mean with $p < 0.851$ for Ho and Tɔŋu dialects and $p < 0.192$ for Aŋɔ, Avenor and Tɔŋu whiles Kpando with F1 mean of 416.25 Hz as a lone subset.

This means that for [e], Aŋɔ, Avenor and Tɔŋu are closer in terms of F1 (height). Ho in turn is closer to Tɔŋu and Kpando is different in terms of height as compared to all the dialects. For F1 of [ɛ], Avenor, Ho, Kpando and Tɔŋu dialects showed a homogeneous subset mean values with no significant difference effect of $p < 0.520$ whiles Aŋɔ has a higher height with F1 mean of 395.20 Hz. Aŋɔ, Avenor, Kpando and Tɔŋu are closer for the height of [ə] whiles Ho speakers realized it with a higher quality with F1 mean value of 428.57 Hz.

With post-hoc comparisons with $\alpha = .05$, the following results were realized. They indicate the homogeneous subsets of differences and similarities of F2¹ of [e] and [ə] among the various dialects.

Table 4.6.2a Tukey HSD^{a,b} result of means of [e] for groups in homogeneous subsets

Dialect	N	Subset for $\alpha = .05$			
		1	2	3	4

Aṇḽ	10	984.57			
Avenor	7	1132.85			
Ho	9		1132.85	1396.00	
Kpando	8		1396.00	1602.22	1602.22
Tɔṇu	10				1768.25
Sig		.594	.092	.271	.485

The above result means that for F2¹ of [e], the dialects are divided into four different subsets. There is a form of continuum here. Aṇḽ is closer to Avenor, and Avenor in turn closer to Ho and Ho closer to Kpando to Tɔṇu.

Table 4.6.2b Tukey HSD^{a,b} result of means of [ə] for groups in homogeneous subsets

Dialect	N			
		1	2	3
Aṇḽ	10	841.14		
Avenor	7	1022.90	1022.90	
Ho	7		1132.00	
Kpando	7			1500.57
Tɔṇu	10			1561.86
Sig.		.326	.778	.966

For F2¹ of [ə], Aṇḽ is closer to Avenor, Avenor to Ho and Kpando to Tɔṇu.

Table 4.6.3 ANOVA of significant of effect of dialect on nasal vowels

Vowels		ĩ	ẽ	ẽ̃	ǣ	ã	ũ	õ	õ̃
Df		43	43	43	42	43	43	41	42
F	F1	2.321	.785	2.718	.124	.484	1.326	2.319	1.166
	F2 ¹	.789	9.341	.511	8.099	.790	1.259	1.770	.238
Sig	F1	.074	.542	.044	.973	.747	.278	.075	.341
	F2 ¹	.539	.000	.728	.000	.539	.302	.156	.915

There are no significant difference between both F1 and F2¹ of the nasalized vowels between all dialects except F2¹ of [ẽ] and [ə]. For the homogeneous subset of means results, Aṇḽ and Avenor are closer at significant effect of p<

0.846 with Avenor being a little closer to Tɔŋu in [ɛ̃] production. Ho, Kpando and Tɔŋu on the other hand are similar with a significant different of $p < 0.413$ in $F2^1$ of this vowel. For [ə], Aŋɔ and Avenor are closer with $p < 0.104$ and Ho, Kpando, and Tɔŋu with $p < 0.390$ significant levels.

4.7 Comparison of $F2^1$ of [a] to $F2^1$ of other Back Vowels

This section compares the tongue advancement (backness) in production of [a] and [ã] to the traditional back vowels to ascertain if they can really be described as back vowels across all the dialects studied. The result is presented in the tables below.

Table 4.7.1 A paired sample test of main effect $F2^1$ of [a] and [u],[o] and [ɔ]

Dialects	Vowel/Significant Level		
	a-u	a-o	a-ɔ
Aŋɔ	.032	.000	.000
Avenor	.094	.013	.001
Ho	.002	.000	.000
Kpando	.065	.007	.000
Tɔŋu	.002	.000	.000

The result indicates that Aŋɔ and Kpando produced [a] with the same tongue advancement as [u] with no significant difference ($p < .032$ and $p < .065$) whiles Avenor produced it at the same place ($p < .094$ and $p < .013$) as [u] and [o] respectively. Ho and Tɔŋu on the other hand have a difference in $F2^1$ of [a] in relation to all the oral back vowels.

Table 4.7.2 A paired sample test of main effect $F2^1$ of [ã] and [ũ],[õ] and [ɔ̃]

Dialects	Vowels /Significant Level		
	ã-ũ	ã-õ	ã-ɔ̃
Aŋɔ	.087	.032	.000
Avenor	.383	.769	.008
Ho	.109	.069	.000
Kpando	.905	.212	.006
Tɔŋu	.282	.523	.009

For the nasalized vowels, all the dialects made [ã] with the same F2' as [ũ] and [õ] except [ĩ] which is more to the periphery of the vowel space with $p < 0.05$ for all dialects. This generally means that [a] as produced by Añɔ, Avenor and Kpando speakers is more of a back vowel than that of Ho and Tɔŋu speakers while [ã] is back in relation of [ũ] and [õ] for all the dialects except [ĩ] which is more back.